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## (54) ELECTRICAL ROTARY HAMMER DRILL

(71) We, HILTI AKTIENGESELLSCHAFT, a Corporation organised and existing under the laws of the Principality of Liechtenstein, of Landstrasse, Schaan, Liechtenstein, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The invention relates to an electrical rotary hammer drill having a commutator motor arranged in a housing, and in which carbon brushes co-operating with the commutator of the motor are mounted in a brush holder, and a fan for producing an air flow which serves to cool windings of the motor is mounted on a shaft of the motor.

Known hammer drills of this kind are usually provided with a commutator motor in which the carbon brushes are arranged opposite one another in the brush holder. The carbon brushes are pressed against the commutator by spring elements. Thus, a part of the outer surface of the commutator is covered by the brushes, whereas the rest remains exposed.

In order to protect the motor's windings from over-heating, it is customary to provide such motors with a cooling ventilator. This latter, comprising usually a fan blade arranged on the motor shaft, sucks cooling air through slots in the housing and blows it in the axial direction through the windings. Subsequently this air passes through further openings back into the open air.

If in the operation of the tool there is any substantial development of dust, as is more especially the case with rock drills, then a proportion of this dust passes with the cooling air into the interior of the motor. Because of the air flow produced by the fan blade,

the sucked-in dust and any other foreign bodies which may be entrained therewith, are whirled around in the housing. If this dust encounters the smooth exposed outer surfaces of the commutator, one suffers the disadvantage that such surfaces rapidly become significantly roughened, which causes considerable wear of the carbon brushes. Moreover, an abrasive effect and sparking and arcing of brushes arises on account of the foreign bodies, so that not only do the carbon brushes wear rapidly but so does also the commutator.

An object of the invention is to minimise these difficulties in such a way that the risk of such rapid wear of the carbon brushes and commutator is reduced by a considerable extent.

Pursuant hereto, the present invention provides an electrical rotary hammer drill having a commutator motor arranged in a housing, and in which carbon brushes co-operating with the commutator of the motor are mounted in a brush holder, and a fan for producing an air flow which serves to cool windings of the motor is mounted on a shaft of the motor, characterised by the provision of a shield which closely surrounds the contact surface or surfaces of the commutator to minimise the possibility of access of dust or foreign matter thereto.

The contact surfaces of the commutator are protected by the shield from the possibility of dust particles impinging directly thereon. Thus, no layer of dirt, which leads to premature wear, can be formed on the contact surfaces of the commutator.

The shield is advantageously annular or ring-shaped in configuration. By this means, the air gap occurring between the commutator and the shield can be kept small around the entire periphery, so that the cooling air flow, which is frequently desired in the case of some tools, can still

circulate along the upper non-contact surface of the commutator.

The shield can, by way of example, also be multi-part in design, which case parts thereof can be fastened to the shaft of the motor and be designed to co-operate with one or more stationary parts thereof along the lines of a labyrinth packing.

In order to facilitate storekeeping of spare parts, it is advantageous to design the shield constructionally in one piece with the brush holder. This also facilitates assembly, so that no special tool expenditure is necessary.

Since the two carbon brushes have to be electrically insulated from one another, it is advantageous if the shield, or the carbon holder, are made of an insulating material, for example a plastics material, in order to save the costs of a separate insulation.

The invention will be described further, by way of example, with reference to the accompanying drawing, in which:—

Fig. 1 is a part-sectional side elevation of a preferred embodiment of the hammer drill of the invention, this tool having been shown with one of its carbon brushes and the holder thereof moved through 90° so as to lie in the plane of the drawing; and

Fig. 2 is a detached sectional plan taken along the line II-II of Fig. 1.

Fig. 1 of the drawing illustrates the entire hammer drill, which can be used selectively for drilling and chiselling as desired and which is designated generally by the numeral 1. The hammer drill includes a tool holder 2 for a tool bit or chisel 3. A mains supply lead 6 connects with a handle 4 which has a push button or pressure switch 5. Situated in a housing of the tool, which housing is designated as a whole by the numeral 7, is an electric motor comprising a rotor which is designated generally by the numeral 11 and on which are fastened armature windings 12, a commutator 13 and a fan 14. The housing 7 is closed by a cover or cap which is designated by the numeral 8 and which incorporates a bearing for the lower end 11a of the shaft of the rotor 11.

When the motor is running, the fan 14 produces a strong current of air which is sucked-in through slots 7a and, after passing through the housing 7 and the windings 12, is blown back into the open air through openings 8a in the cover or cap 8. This arrangement of the fan 14 is to be understood to have been shown purely as an example; it is also possible for the fan

14 to be arranged above the armature windings 12, and for the cooling air flow then to be effected in the reverse direction.

Designated by the numeral 10 is a shield which, in accordance with the invention, is provided for the commutator 13. This closely surrounds the outer contact surfaces of the commutator 13 so as to minimise the possibility of access of dust or foreign matter to such surfaces. This shield 10 is, in the example shown, is in one piece with a brush holder, which is designated as a whole by the numeral 9. The brush holder 9 comprises an outer guide ring 9a which is supported in the housing 7, as well as connecting cross-pieces 9b which are more especially evident from Fig. 2. Situated within these connecting crosspieces 9b are actual brush guides 17 in which carbon brushes 16 are loaded, by springs 18, towards the commutator 13. Electrical connection from stator 15 of the motor to the brush guides 17 is provided for by respective contact elements 19.

#### WHAT WE CLAIM IS:—

1. An electrical rotary hammer drill having a commutator motor arranged in a housing, and in which carbon brushes co-operating with the commutator of the motor are mounted in a brush holder, and a fan for producing an air flow which serves to cool windings of the motor is mounted on a shaft of the motor, characterised by the provision of a shield which closely surrounds the contact surface or surfaces of the commutator to minimise the possibility of access of dust of foreign matter thereto.

2. A drill as claimed in Claim 1, characterised in that the shield is annular or ring-shaped in configuration.

3. A drill as claimed in Claim 1 or 2, characterised in that the shield and the brush holder are in one piece.

4. A drill as claimed in claim 1, 2 or 3 characterised in that the shield is formed of insulating material.

6. An electrical rotary hammer drill substantially as hereinbefore described with reference to and as illustrated in the accompanying drawing.

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